OhioEPA

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Ted Strickland, Governor
Lee Fisher, Lieutenant Governor
Chris Korleski, Director

Re: Seneca County
Sunny Farms Landfill
Ground Water

May 23, 2007

Mr. Michael Holmes
Regus Industries, LLC
2730 Transit Road
West Seneca, New York 14224

Dear Mr. Holmes:

The Ohio Environmental Protection Agency (Ohio EPA) has reviewed the Semiannual Determination of Rate, Extent, and Concentration - November 2006 Groundwater Quality Assessment Monitoring Event for the Sunny Farms Landfill. The report was dated January 2007 and received by Ohio EPA on January 26, 2007.

The Sunny Farms Landfill is located in Louden Township, Seneca County, Ohio. Seven wells are in assessment monitoring. Sixteen wells are in detection monitoring. Based on Ohio EPA's evaluation, the facility is presently operating under the correct ground water monitoring phases, the well system is adequate for the detection monitoring and the owner/operator should continue to monitor under the current program. Ohio EPA reviewed the report in order to determine compliance with OAC Rule 3745-27-10.

The report is signed by a qualified ground water scientist, but the signature is not notarized.

COMMENTS

VIOLATIONS

1. Ohio Administrative Code (OAC) Rules 3745-27-10(C)(5)(b). The owner/operator is in violation of OAC Rule 3745-27-10(C)(5)(b), requiring **Background ground water quality at a sanitary landfill facility may be based on sampling of wells that are not hydraulically upgradient where either of the following occur:**

   (b) Sampling of other wells will provide an indication of background ground water quality that is as representative or more representative than that provided by upgradient wells.

A. According to the report, page 11, paragraph 1, "**The background database used for interwell statistics was constructed using historical groundwater quality data from upgradient/sidegradient monitoring wells MP-9A, MP-10A, MP-11A, MP-12A, MP-13A, MP-14A, MP-15A, MP-16A, and MP-18A.**

Wells MP10A, MP13A, and MP15A are not upgradient of the landfill cells according to the potentiometric surface maps submitted with the semiannual data submittals. In telephone conversations on December 13, 2006 and December 26, 2006, Brent Smith with Burgess and Niple was informed that the data for wells MP10A, MP13A and MP15A (15A after the July 1, 2005 sampling event) were sidegradient to the waste and the data collected from these wells should not be used in the background data set for statistical analyses. The data from these wells was collected after waste was placed in cells sidegradient to the wells.

B. According to comment 1 in the Ohio EPA letter dated March 12, 2007 **The owner/operator has adequately addressed the violation of Ohio Administrative Code (OAC) Rule 3745-27-10(C)(7)(e) as described below. As a result of the updating of the background data set , compliance with OAC Rule 3745-27-10(C)(4), (B)(3), and (C)(7)(f) cannot be determined. Note that this comment is being made by Ohio EPA prior to completing a thorough review of the reports received concerning the November 2006 sampling event.** The comment contained a discussion of the wells contained in the SZS monitoring system.

The comment further stated **In updating the background data set the owner/operator has added six (6) wells to the upgradient portion of the monitoring system for the significant zone of saturation (SZS); this makes a total of nine (9) wells. The data from the six wells has been added to the background data set.**

Three of the wells MP10A, 13A and 15A are currently sidegradient or downgradient; therefore, the data for these three wells cannot be used in the background data set.

The Ohio EPA has conducted further investigation of the monitoring system for the SZS . The owner/operator has indicated, <u>for the first time with the November 2006 sampling event</u>, that there are nine upgradient wells in the monitoring system for the SZS (MP9A, 10A, 11A, 12A, 13A, 14A, 15A, 16A, and 18A). According to data submitted to the Ohio EPA the only upgradient wells for the SZS, currently, are MP11A , and 14A.

According to OAC Rule 3745-27-10(C)(4): **The owner or operator shall establish background ground water quality, unless the exception in paragraph (C)(5) of this rule applies, by analyzing ground water samples collected from hydraulically upgradient wells(s) for each of the monitoring parameters or constituents required in the ground water monitoring program.**

On June 20, 2002 Ohio EPA sent a letter to the owner/operator of the San Lan Landfill (Sunny Farms Landfill). The letter contained the Ohio EPA revision of the ground water quality assessment plan required by the Consent Order, VI. Injunctive Relief, number 16 filed on October 23, 2001. The monitoring system for the SZS was based on the construction of the phases of the landfill. At that time the upgradient wells for phase 1 - MP9A, 11A, 13A, 15A, and 18A; for phase 2 - MP9A, 11A and 15A; phases 3-7 - MP11A. The plan was revised so that only ground water quality data from wells that meet the requirement of OAC Rule 3745-27-10(C)(4) are added to the background data set for statistical analysis. Prior to the consent order, it was determined by the owner/operator (see comment 2 below) that well MP12A was not screened in the same zone as the other SZS wells and background needed to be established again. Starting with the June 2002 sampling event, the owner/operator began collecting background data for wells MP9A, 11A and 15A. According to the September 2005 data report (June 2005 sampling event), "**...MP-9A was utilized as a downgradient monitoring well for the first time during the June 2005 sampling event.**" At this point in time until the November 2006 sampling event wells MP11A and 15A were the upgradient wells according to the data reports submitted by the owner/operator. The Ohio EPA addressed the issue of well MP9A in two letters dated February 16, 2006 (comment 9 on page 6) and August 18, 2006 (comment 9 on page 16) "*According to the report, page 11, section 5.2.2, lines 5-8, ...**Construction of Phase 3 of the waste disposal cell was completed in August 2005; therefore, monitoring well MP-9A will be monitored as a downgradient well per the existing revised GDMP (B&N, June 2005). As long as this well remains in detection monitoring, this well will continue to be used for background interwell statistics.** Well MP-9A is no longer an upgradient well. Data collected from well MP-9A cannot be added to an upgradient data pool for the calculation of interwell statistical analyses.*" As stated above in this comment, the owner/operator has indicated, <u>for the first time with the November 2006 sampling event</u>, that there are nine upgradient wells in the monitoring system for the SZS (MP9A, 10A, 11A, 12A, 13A, 14A, 15A, 16A, and 18A).

The background data set was updated in the Semiannual Determination of Rate, Extent, and Concentration - November 2006 Groundwater Quality Assessment Monitoring Event dated January 2007 to include data collected from sidegradient wells MP10A,13A, and 18A. Wells MP10A and MP13A have never been considered to be upgradient wells. The data set also contains data for wells

MP9A and 15A which were collected after these wells became sidegradient. MP9A became sidegradient in April 2005. MP15A became sidegradient in August 2005. As discussed below in portion C of this comment below well MP16A cannot be used as an upgradient well for SZS. It is not monitoring the same SZS as the other A series wells (screened in only clay like well MP12A).

Table 1 below contains the status of the wells at a particular phase of construction. Table 2 contains the time periods that the data is usable as upgradient/background for statistical analyses.

Table 1

	MP9A	MP10A *	MP11A	MP13A	MP14A	MP15A	MP16A	MP18A
Phase								
1	UG		UG	UG	n/a	UG	n/a	UG
2	UG	n/a	UG	SG	n/a	UG	n/a	**DG/SG**
3	**DG** (3C)	n/a	UG	SG	n/a	SG (3D)	n/a	**DG**
4	**DG**	DG/SG	UG	SG	UG	SG	UG	**DG**
5	**DG**	DG/SG	UG	**DG**	UG	**DG**	UG	**DG**
6	**DG**	DG/SG	UG	**DG**	UG	**DG**	UG	**DG**
7	**DG**	DG/SG	UG	**DG**	UG	**DG**	SG	**DG**

*only samples were collected on November 14, 2006

Based on the above discussion and Table 1, the usable data for the background data set should be as follows:

Table 2

	MP9A	MP10A*	MP11A	MP13A	MP14A	MP15A	MP16A$	MP18A
Starting Date	1/16/02	none	9/23/92# (01/15/02)	none	11/14/06	01/16/02	none	3/2/99^ (06/25/01)
Ending Date	11/16/04	none	as long as it is in detection monitoring	none	as long as it is in detection monitoring	0701/05	none	1/16/02

*only samples were collected on November 14, 2006 # 9/23/92 for indicator parameters and 01/15/02 for other parameter ^3/2/99 for indicator parameters, 6/25/01 for other parameters $well MP16A is not screened in the SZS; therefore data from the well is not representative of the ground water quality in the SZS see comments 8 and 9 below

C. Well MP16A is not monitoring a SZS. The boring log for well MP16A shows that from 0 to 33.13 feet the only material observed was clay. The screen and sand pack was installed from 24 to about 33. feet in clay. There are no descriptions on this log as to moisture content. The screens for the other SZS wells, except MP12A, were installed in silty clay to sand. Well MP16A is not screened in the SZS being monitored by all the A wells except well MP12A.

In order to return to compliance with OAC Rules 3745-27-10(C)(5)(b), the owner/operator needs to: (A) remove the data for wells MP10A, MP13A, and MP15A from the background data set for any statistical analyses and conduct the statistical analyses again. Tables 1, 6, 7, 9, and 11 will need to be corrected. Statistical analysis is not required in assessment monitoring; therefore, the owner/operator can also return to compliance by comparing the downgradient assessment well data to the revised upgradient data. (B) The owner/operator needs to update the background data set by removing, from the background data set, any data collected for a well when it became a sidegradient/downgradient well and data from any well never considered to be an upgradient well (MP10A, 13A, 16A) [see the Table 1, above for status of the wells at a particular phase of construction, and Table 2 for the time periods that the wells were/are considered upgradient]; and (C) the owner/operator should (1) not use MP16A as an upgradient monitoring well, (2) remove the data for well MP16A from the background database for interwell statistical analyses, (3) conduct the statistical analyses without the data from MP16A in the background database, and (4) the well should be properly plugged and abandoned.

2. OAC Rule 3745-27-10(C)(4),and (B)(1)(a). The owner/operator is in violation of OAC Rule 3745-27-10(C)(4) requiring **The owner or operator shall establish background ground water quality, unless the exception in paragraph (C)(5) of this rule applies, by analyzing ground water samples collected from hydraulically upgradient wells(s) for each of the monitoring parameters or constituents required in the ground water monitoring program.**

and OAC Rule (B)(1)(a) requiring, **The ground water monitoring system, for detection monitoring, assessment monitoring, or corrective measures, shall consist of a sufficient number of wells, installed at appropriate locations and depths, to yield ground water samples from both the uppermost aquifer system and any significant zones of saturation that exist above the uppermost aquifer system that do the following: (a) Represent the quality of the background ground water that has not been affected by past or present operations at the sanitary landfill facility.**

Well MP12A was the original upgradient well for the SZS. It was removed from the system based on a letter dated August 2, 2001 from Mark Ruoff of the Mark James Corporation and the letter dated August 16, 2001 from Mike Leone of Burgess and Niple both consultants for the previous owner/operator. The owner/operator has placed it

back into the SZS monitoring system as an upgradient well based on the same reasons it was removed, in the first place. The Ohio EPA has reviewed the boring logs, and the ground water quality data for MP12A and the other SZS wells. There are four reasons for not including well MP12A in the SZS monitoring system:

1. Well MP12A is not monitoring a SZS. The boring log for well MP12A shows that from 0 to 29.9 feet the only material observed was clay. The screen and sand pack was installed from 18 to 29.32 feet in dry clay. The screens for the other SZS wells were installed in silty clay to sand; MP16A monitors a clay zone.

2. The ground water quality data is drastically different from the other current and proposed upgradient monitoring wells in the SZS. The data for arsenic, barium, beryllium, chromium, cobalt, lead, manganese, nickel, potassium, silver, vanadium, and zinc are significantly higher in well MP12A than any other SZS well. In fact, the only detections of beryllium and silver were in well MP12A. The inclusion of the data for well MP12A in the background data set creates a data set with spatial variability. According to the letter dated August 2, 2001 from Mark Ruoff, **The continued progress of the groundwater quality assessment plan has been impacted by the fact that the groundwater samples collected from well MP-12A may not represent the water quality of the uppermost significant aquifer. Removal of MP-12A from the groundwater monitoring program eliminates the approved water quality background data set for the uppermost significant saturated unit.**

3. According to the letter dated August 2, 2001 from Mark Ruoff, **A review of the geologic and well completion logs, however, allows the conclusion to be made that well MP-12A is not acceptable as a background well. The geologic log shows that the A-Series sand/sandy clay unit is not present at well MP-12A. Furthermore, the well was completed with the bottom of the PVC well casing in direct contact with the upper part of the dolomite bedrock. It is apparent that the well probably does not monitor the exact same significant saturated unit as the other wells at the facility.** According to a letter dated August 16, 2001 from the owner/operator, **Based on the boring log ... MP-12A is screened at the unconsolidated deposits/ bedrock surface** [according to the boring log the base of the screen/sand pack is 0.58 feet above the interface]. **The unconsolidated deposits at MP-12A consist entirely of clay. The low groundwater yield experienced at MP-12A during each sampling event confirms that the screened interval is within fine-grained silt and clay at this location** [the log for this well only shows clay for the first 29.9 feet this distinctly different from all of the other SZS wells, the geologist on site described it as clay not silty clay, etc.]. **Other monitoring wells at the San-Lan Landfill are screened across a thin silt and sand layer just above bedrock** [1 well base of screen/sand pack on bedrock, 20 wells base of screen/sand pack 0.44 to 8 feet above bedrock, MP12A 0.68 feet above bedrock]. **Groundwater quality at MP-12A has been noticeably different**

than the other Zone A monitoring wells. Clay particles promote cation exchange, which can often alter the chemistry of groundwater. This may be the reason for the different geochemistry observed at MP-12A.

In order to meet the requirements of ...10(B)(1)(a), a more representative background database must be established so that groundwater quality downgradient of the facility, specifically at assessment monitoring wells MP-2AR and MP-7AR, can be properly evaluated.

4. Ohio EPA used linear regression analysis to evaluate the effects of sample turbidity on total metal, calcium, chloride, potassium, sulfate, sodium and ammonia nitrogen analytical results for well MP12A, and MP11A . As seen in Table 1 below, the background data for well MP12A for nine metals, potassium and calcium are influenced by turbidity (i.e., total metals, potassium and calcium concentrations are artificially elevated and the variation of these parameter concentrations is artificially increased). The regression analyses for upgradient well MP11A show no affects from turbidity on the total metal, calcium, chloride, potassium, sulfate, sodium and ammonia nitrogen concentrations.

In telephone conversations on December 13, 2006 and December 26, 2006, Brent Smith with Burgess and Niple was informed that the data collected for well MP12A should not be used in the background data set for statistical analyses. The results from the samples collected from well MP12A are not representative of the quality of the background ground water that has not been affected by past or present operations at the sanitary landfill facility. In order to return to compliance with OAC Rule 3745-27-10(C)(4),and (B)(1)(a) , the owner/operator needs to remove the data from MP12A and conduct the statistical analyses again , MP12A cannot be used as an upgradient monitoring location in any future sampling events, and the well should be properly plugged and abandoned.

3. OAC Rule 3745-27-10(C)(5)(b): The owner/operator is in violation of OAC Rule 3745-27-10(C)(5)(b) requiring, (see comment 1 above for the citation of the rule)

According to the report, section 6.2, page 17, "...The following Appendix I constituents were determined to be above background concentration: chloride in MP-2AR; and ammonia, calcium, chloride, iron, magnesium, potassium, selenium, sodium, total alkalinity, and TDS in MP-7AR..."

For reasons discussed in comments 1 and 2 above and comment 6 below , some of the background data used to calculate tolerance limits cannot be used for that purpose. When the data for wells MP10A, MP12A, MP13A, MP15A and MP18A are removed, the tolerance limits will be lower for several parameters. For instance, Table 1 below contains the parameters if a nonparametric (the owner/operator has used the highest historical concentration from well MP12A as the statistical limit) limit was used for statistical comparisons.

Table 1
Nonparametric Tolerance Limits

Parameter	Current Tolerance Limit	New Tolerance Limit	Wells with detections over new tolerance limits
Arsenic	79.0 ug/L	<PQL (<5ugl)	MP1AR, 2AR, 4A, 7AR, 8AR, 20A, 24A, 25A, 26A, 27A
Barium	680 ug/L	26.6 ug/L	MP1AR, 3A, 7AR, 8AR, 10A*, 14A*, 15A, 16*
Beryllium	6.30 ug/L	<PQL (<1ug/l)	none
Chromium	93 ug/L	4.4 ug/L	MP1AR
Cobalt	120 ug/L	<PQL (<5ug/l)	MP1AR,7AR, 8AR,
Manganese	2.7 mg/L	1.09 mg/L	MP7AR,
Nickel	220 ug/L	27.2 ug/L	MP7AR
Silver	1.1 ug/L	<PQL (<0.5ug/l)	none
Vanadium	0.092 ug/L	0.0025 ug/l	1AR, 7AR, 16A*
Zinc	540 ug/L	85 ug/L	MP8AR

*only one sample , cannot determine if result caused by turbidity

The owner/operator needs to calculate new statistical limits (parametric and nonparametric) for all of the parameters and submit a new list of parameters that exceed the calculated limits as required by OAC Rule 3745-27-10(E)(5)(c) in order to return to compliance.

4. OAC Rule 3745-27-10(C)(1)(a): The owner/operator is in violation of OAC Rule 3745-27-10(C)(1)(a) requiring, **A written sampling and analysis plan, which documents the sampling and analysis procedures that shall be utilized in the ground water monitoring program. The owner or operator is required to use the procedures documented within the sampling and analysis plan.**

According to the ground water quality assessment plan (GWQAP) revised November 2006, page 37, section 6.10.2, "Minimum / no purge sampling will be conducted for monitoring wells that yield an insufficient volume for low-flow purge techniques (less than 100 ml/min)."

According to the Groundwater Well Development Record Form for well MP13A attached to the letter dated January 19, 2007 from Burgess and Niple, the well was pumped at 100 ml/min for 20 minutes and the water level rose from 20.75 feet btoc to 20.70 feet

btoc and then dropped to 20.73 feet btoc. This indicates that the well can yield at least 100 ml/min. The owner/operator is in violation for not following the GWQAP. In order to prevent this violation in future sampling events, the owner/operator should follow the procedures contained in the GWQAP.

5. OAC Rule 3745-27-10(C)(9). The owner/operator is in violation of OAC Rule 3745-27-10(C)(9) requiring, **The number of samples collected to establish ground water quality data shall be consistent with the appropriate statistical procedures determined pursuant to paragraphs (C)(6) and (C)(7) of this rule.**

   The owner/operator has conducted statistical analyses using interwell tolerance limits. A minimum of 8 background samples are required for conducting statistical analyses. According to the table in Appendix F of the Semiannual Determination of Rate, Extent, and Concentration - November 2006 Groundwater Quality Assessment Monitoring Event dated January 2007, there were insufficient background samples available for conducting statistical analyses for the following parameters: cadmium (no values), tin (6 values, 1 when unusable data is removed) and silvex (no values). According to the table in Appendix F, n (STAT) is zero for all three parameters.

   In order to regain compliance with OAC Rule 3745-27-10(C)(9), the owner/operator should do one of the following: a) add in the less than detection data that was removed. The nondetect data that was removed from the background data set should be entered into the statistical program as ½ the lowest PQL/detection limit or the highest detected value in the case of nonparametric tolerance limits (i.e., cadmium should be 0.100 ug/l, tin should be 150 ug/l and silvex should be 0.0474 ug/l); or b) collect additional samples for each parameter so that there are 8 background samples for each parameter at each well using the lowest PQL; or c) compare the assessment wells data to the upgradient wells data without using statistical analyses, since statistical analysis is not required in assessment monitoring.

6. OAC Rule 3745-27-10(C)(1). The owner/operator is in violation of OAC Rule 3745-27-10(C)(1), **The ground water monitoring program shall include consistent sampling and analysis procedures and statistical methods that are protective of human health and the environment and that are designed to ensure monitoring results that provide an accurate representation of ground water quality at the background and downgradient wells installed in accordance with paragraph (B), (D), (E), or (F) of this rule**

   The Semiannual Determination of Rate, Extent, and Concentration - November 2006 Groundwater Quality Assessment Monitoring Event dated January 2007 included 211 ground water sample turbidity values for the significant zone of saturation (SZS) wells. These values range over seven orders of magnitude, from 0.025 nephelometric turbidity units (NTUs) to 29,000 NTUs. At individual wells, the turbidity range varies from six orders of magnitude (1 to 29,000 NTUs, MP3A) to one order of magnitude (3.61 to 65 NTUs, MP9A).

In general, due to the slow movement of ground water, its *in-situ* turbidity is expected to be low (less than 5 NTUs).[1] Based on the Semiannual Determination of Rate, Extent, and Concentration - November 2006 Groundwater Quality Assessment Monitoring Event dated January 2007 , the ground water flow velocity in the SZS is approximately 0.138 to 1.69 feet per year. Based on the calculation by the Ohio EPA, the ground water flow velocity is 14.7 feet/year. Neither of these ground water flow velocity values would not be expected to cause turbidity ranging from hundreds to thousands of NTUs.

In Ohio EPA's opinion, the observed range of turbidity values are more likely the result of inadequate monitoring well construction, development, and/or sampling methods than natural variations in ground water conditions.[2, 3] Based on Ohio EPA's experience, consecutive turbidity measurements of individual wells typically vary within one or two orders or magnitude, assuming proper well construction and development and sampling methods that consistently generate representative ground water samples. Furthermore, turbidity measurements typically vary within one to three orders of magnitude among wells installed in the same hydrogeologic unit, assuming similar stratigraphic and hydrogeologic conditions among well locations, adequate monitoring well construction and development, and sampling methods that consistently generate representative ground water samples. Although turbidity from monitoring wells installed in clay-rich unconsolidated deposits (e.g., soils or till) or bedrock (*e.g.*, shale) may remain elevated even in properly constructed and developed monitoring wells, use of low-flow sampling techniques generally reduces sample turbidity to an acceptable level that does not adversely affect the representativeness of inorganic parameter analyses.[4] At this site there have been very high turbidity concentrations in samples even when collected using low flow methods.

Ohio EPA used linear regression analysis to evaluate the effects of sample turbidity on total metal, calcium, chloride, potassium, sulfate, sodium and ammonia nitrogen analytical results for SZS wells. The spreadsheet was set up to run regression analyses for those parameters with historic databases that include at least two samples with detected values and associated turbidity measurements. (Duplicate sample results were not used.) Non-detect values were addressed by using one-half of the detection limit in the regression analyses (*e.g.*, 2.5 ug/l was used for a non-detect of < 5 ug/l). Regression analysis assumptions, results, and supporting data are presented in Attachment A; all analyses were performed using *Quattro Pro 10* (constructing a simple linear regression function by using the @ CORREL equation in the spreadsheet).

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[1]Nightingale, H.I., and W.C. Bianchi, 1977, *Ground-Water Turbidity Resulting From Artificial Recharge*: Ground Water, Vol. 15, No. 2, pp. 146-152.

[2]U.S. EPA, November 1993, *Solid Waste Disposal Facility Criteria Technical Manual*: Office of Solid Waste and Emergency Response, EPA 530-R-93-017, pp. 241-253.

[3]Puls, R.W., and R.M. Powell, 1992, *Acquisition of Representative Ground Water Quality Samples for Metals*: Ground Water Monitoring Review, Vol. 12, No. 3, pp. 168-172.

[4]Puls, R.W., and M.J. Barcelona, 1996, *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*: U.S. EPA Office of Solid Waste and Emergency Response, EPA/540/S-95/504, pp. 2, 5-6.

Table 1 summarizes the regression analyses results for SZS wells. Based on the regression analyses of the samples in the SZS wells, concentrations on Table 1 exhibit coefficients of regression (r^2) exceeding 0.60 (r = 0.77).

The r^2 value indicates the approximate proportion of the dependent variable's variance that appears to be explained by the independent variable.[5] For example, the 0.956 r^2 for the regression analysis of total arsenic (dependent variable) and turbidity (independent variable) indicates that approximately 95.6% of the variation in arsenic concentrations appears to be related to turbidity variation. The square root of the r^2 value is the correlation coefficient (r); r = 0 indicates no correlation between two data sets, and r = 1 indicates a perfect correlation between two data sets.[6]

Table 1

8AR		Copper	Iron	Magnesium	Nickel	Zinc		
	r	.826	.804	.797	.778	.786		
	r^2	.682	.647	.636	.605	.618		
15A		Nickel						
	r	.994						
	r^2	.989						
18A*		Arsenic	Barium	Copper	Chromium	Lead	Vanadium	
	r	.978	.83	.997	.997	.997	.997	
	r^2	.956	.688	.995	.995	.995	.995	
20A		Iron	Manganese					
	r	.880	.877					
	r^2	.776	.770					
12A		Potassium	Arsenic	Barium	Beryllium	Cobalt	Copper	Lead
	r	.847	.787	.922	.908	.946	.908	.948
	r^2	.717	.620	.850	.824	.895	.825	.899
		Nickel	Zinc	Calcium	Chromium			
	r	.897	.944	.797	.861			
	r^2	.805	.892	.636	.742			

*considered by the owner/operator to be an upgradient well for background data purposes. considered to be a sidegradient/downgradient well by Ohio EPA (see comment 7 below)

[5]Steel, G.D., and J.H. Torrie, 1980, *Principles and Procedures of Statistics, A Biometric Approach* (Second Edition): McGraw-Hill Book Company, pp. 249-252.

[6]Steel, G.D., and J.H. Torrie, 1980, *Principles and Procedures of Statistics, A Biometric Approach* (Second Edition): McGraw-Hill Book Company, pp. 272-278.

Increased turbidity results in increased concentrations for some metals because the required field preservation (acidification) of the ground water samples to pH < 2 removes some adsorped metal cations from clay and organic particles.[7] Previous studies have demonstrated that elevated sample turbidity causes elevated total metals concentrations.[8] Ohio EPA does not consider total metal concentrations that appear to be a function of turbidity (a relative estimate of the amount of suspended mineral matter in the ground water sample) to be representative of ground water quality.

Arsenic is an assessment parameter. As discussed above, the background data for arsenic are influenced by turbidity (*i.e.*, total arsenic concentrations are artificially elevated and the variation of arsenic concentrations is artificially increased), specifically MP18A [Considered by the owner/operator to be an upgradient well for background data purposes. Considered to be a sidegradient/downgradient well by Ohio EPA (see comment 1 above)]. Such a situation is a serious concern with respect to statistical comparison to the downgradient monitoring wells, because it increases the probability of false negatives (the failure to statistically detect a release when one has occurred). However, the referenced downgradient monitoring wells exhibit statistically significant concentrations of other parameters. If the turbidity-impacted data were to be removed from background, the downgradient wells in assessment would exhibit statistically significant arsenic concentrations. Regression analysis of pooled arsenic and turbidity data for MP1AR, 2AR, 3A, 4A, 7AR, 8AR, 20A, 24A, 25A, 26A and 27A results in a very low r^2 of 0.158 ($r = 0.398$) indicating that no apparent relationship exists between arsenic and turbidity in the downgradient assessment wells. (Regression analysis of pooled arsenic and turbidity data for MP18A [considered by the owner/operator to be an upgradient well for background data purposes. Considered to be a sidegradient/ downgradient well by Ohio EPA (see comment 1 above)] results in a high r^2 of 0.956, with a corresponding r value of 0.978). Considering the elevated arsenic concentrations (6 to 750 ug/L) occurring in the MP1AR, 2AR, 3A, 4A, 7AR, 8AR, 20A, 24A, 25A, 26A and 27A databases, the low r^2 for arsenic versus turbidity points toward a source of dissolved arsenic such as leachate from Sunny Farms Landfill.

As seen in Table 1 above, the background data for well MP12A for nine metals, potassium and calcium are influenced by turbidity (i.e., total metals, potassium and calcium concentrations are artificially elevated and the variation of these parameter concentrations is artificially increased). MP12A is considered by the owner/operator to be an upgradient well for background data purposes. MP12A is not monitoring the SZS as detailed in comment 2 above.

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[7]McLean, J.E., and B.E. Bledsoe, 1992, *Behavior of Metals in Soils*: U.S. EPA Office of Solid Waste and Emergency Response, EPA/540/S-92/018, pp. 9-10.

[8]Gibbons, R.D., and M.N. Sara, *Statistical Comparison of Metals Concentrations in Filtered and Unfiltered Ground-Water Samples*, in Ground Water Sampling, A Workshop Summary: Dallas Texas, November 30 – December 2, 1993, U.S. EPA Office of Research and Development, EPA/600/R-94/205, pp. 54-58.

Table 2 shows the results of regression analyses for total metal concentrations versus turbidity for MP4A, a downgradient detection monitoring well. Two analyses were performed: one using turbidity data ranging from 7.9 to 6200 NTUs and the other using turbidity data ranging from 7.9 to 195 NTUs (the data used for this analyses were the same as the first analyses except that data from six samples with turbidity values of 290, 720, 1200, 3300, 4600 and 6200 NTUs were excluded). The first analysis resulted in r^2 values less than 0.225 for all metals; the second analysis resulted in r^2 values of less than 0.29 for the same metals.

Table 2

	arsenic	barium	beryllium	cadmium	chromium	cobalt	copper	lead	nickel
	High	Turbidity	Values						
r	0.215	0.216	0.247	0.473	0.301	0.282	0.260	0.221	0.297
r^2	0.046	0.046	0.061	0.224	0.090	0.079	0.067	0.049	0.088
	High	Turbidity	Values	>200 NTU	Removed				
r	-0.297	-0.310	-0.07	.53	-0.238	-0.279	-0.190	-0.231	-0.281
r^2	0.088	0.096	0.006	0.28	0.056	0.078	0.036	0.053	0.079

	selenium	silver	thallium	vanadium	zinc	iron	magnesium	manganese
	High	Turbidity	Values					
r	-0.050	-0.023	0.366	0.268	0.174	0.143	0.497	0.262
r^2	0.0025	.0005	0.134	0.071	0.030	0.020	0.247	0.069
	High	Turbidity	Values	>200 NTU	Removed			
r	ERR	ERR	0.125	0.056	-0.214	-0.190	0.077	-0.236
r^2	ERR	ERR	0.015	0.003	0.045	0.036	0.005	0.055

The SZS wells databases include metals with concentrations that are elevated due to elevated sample turbidity and therefore are not representative of background ground water quality. Such data should not be used for statistical comparisons as doing so results in an unacceptable false negative rate (failure to statistically detect a release when one has occurred).

Since the metals in the downgradient wells are not due to turbidity, except those listed in Table 1, what is the source for the metals? It appears the only choice is the leachate from the landfill. Leachate produces reducing conditions as it passes through the significant zone of saturation and as it moves through the zone it is causing the metals to be released from the unconsolidated deposits/soils.

In order to regain compliance with OAC Rule 3745-27-10(C)(1) the owner/operator should: (1) remove from the SZS background database all data that does not provide an accurate representation of ground water quality at the background and downgradient wells (see the list in Table 1 for the wells and parameters) associated with NTUs greater than 110, above 140 NTUs for MP12A; (2) conduct statistical analyses using the updated background data set; (3) redevelop wells as necessary and use sampling techniques to consistently produce ground water samples with a turbidity less than 110 NTUs.

STATEMENTS

7. According to the report, page19, section 6.4, last sentence, **Based upon these calculations, the average linear flow velocity ranges from 0..138 to 1.69 ft/year across the site.**

   Arsenic was detected above the detection limit (5 ug/L) in well MP20A, indicating the contamination has reached at least that far. Chloride and arsenic were detected above the detection limits in wells MP24A, 25A and 26A indicating the contamination has reached at least that far. The landfill has been taking waste since 1970, 34 years (based on the time this statement was first provided to the owner/operator). The distance from the limits of waste placement and well MP26A is approximately 500 feet. The rate of flow based on 34 years and 500 feet is 14.7 feet/year, at a minimum.

8. The owner/operator was informed in letters dated June 4, 2004 (4076), December 6, 2004 (4547), March 24, 2005 (4930), March 22, 2006 (5731), and January 9, 2007 that there was a violation for not determining the full extent of the contamination according to OAC 3745-27-10(E)(6)(a). The owner/operator has not adequately addressed the violation at this point in time.

9. According to the monitoring well logs in appendix C of the Groundwater Detection Monitoring Plan (GWDMP), Wells MP3A, 4A, 9A, 10A, 11A, 12A, 13A, 14A, 15A, 16A, and 18A consist of four inch schedule 40 casings and screens installed in six inch boreholes. PVC casing schedule 40 pipe has an outside diameter of 4.5 inches. With an outside diameter of 4.5 inches there is less than 1 inch of space around the casings for the placement of the sand pack. According to the Ohio EPA Technical Guidance Manual for Hydrogeologic Investigations and Ground Water Monitoring, Chapter 7, page 7-12, "The distance between the casing and the borehole wall should be at least 2-4 inches to allow for the proper placement of the filter pack and annular seal. Therefore, the filter pack thickness should be 2 to 4 inches."

If you have any questions please contact Jack Leow at the Ohio EPA, Northwest District Office, Division of Drinking and Ground Waters, 347 N. Dunbridge Rd., Bowling Green, Ohio 43402. Submit all reports/data to MaryAnn Miller, Ohio EPA, Northwest District Office, Division of Solid and Infectious Waste Management, 347 N. Dunbridge Rd., Bowling Green, Ohio 43402.

Sincerely,

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/cs

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